Consultation on Agenda 2030: One Nation. Labour's Plan for Science

University Alliance response, July 2014

Introduction

1. University Alliance is a non-partisan, non-political organisation working to promote, safeguard and sustain the public benefit delivered by universities. Our thought leadership work helps inform wider debate about the future of universities and their role in the UK economy and society, including the wide-ranging university_vision think piece which has been used across the sector and abroad.[1]
2. University Alliance brings together 22 of the UK's leading innovative and enterprising universities – major institutions combining science, technology and the creative industries with a focus on delivering for the professions, business and the community. Alliance universities are central to the UK's knowledge economy, driving growth in new sectors and markets through the delivery of high quality science, research and industry-ready graduates.
3. By operating a 'revolving door' with business, Alliance university staff and students are encouraged to move between both throughout their careers. This ensures that the benefits of research are more widely felt by increasing the absorptive capacity of industry through human and intellectual capital. A key feature of activity is supporting new growth industries and regional development through major partnerships with the likes of Siemens, Hewlett-Packard and GSK, as well as thousands of SMEs. Over 75% of FTSE 100 companies have sponsored their staff to study within an Alliance institution, and our universities have up to 70% of all courses professionally accredited. Alliance universities work closely with employers to provide 50% of sandwich work placements, lead over one-third of all UK knowledge transfer partnerships and support graduate entrepreneurialism–nearly half (46%) of all turnover from graduate start-ups comes from businesses started by Alliance graduates.
4. Given Alliance universities' research expertise and capacity to translate the results and benefits of research into real-world impact as well as educating 25% of all graduates essential to the future success of the UK's knowledge economy, they form a unique and vital part of the UK science ecosystem. We are delighted to contribute to Labour's critical consultations on the future of this ecosystem.

[1] http://www.unialliance.ac.uk/blog/2012/11/15/what-is-your-vision-for-universities/

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Summary

5. Universities are central to the UK's science and research ecosystem and the knowledge economy. In the UK's global, knowledge-based economy, where 80% of new jobs are in high-skill areas[2] and new and growth industries take a high-tech, high-skill and innovative approach, universities are playing a critical role in driving the UK's economic future alongside and in partnership with businesses.

6. We welcome the One Nation principle of **long-term certainty on investment** and **urge real terms increases to the science budget** to bring the UK's investment in line with international R&D averages. We must prioritise investment in the existing infrastructure if we are to future-proof the vitality and competitiveness of the UK science and research ecosystem.

7. British science is central to innovation. Open innovation needs open competition, however – so a commitment to the principle of seeking and funding research excellence wherever it is found must continue to be an essential priority. The ability of the UK to respond to global challenges and industrial opportunities in the future will rely on maintaining the strength and depth of the research base in both subject areas and research activities.

8. Connectivity, collaboration and openness is essential to the future of world-leading science, and therefore need to be embedded within the focus and approach of any science strategy. Efficiency savings, for example those made through asset sharing, are another important benefit of collaboration and we are undertaking and supporting efforts at the national level to improve the sharing of resources amongst universities and the wider research ecosystem.

9. Committing to a long-term strategy, including Big Challenge-led priorities, would be an important part of shaping a joined-up and excellent system. University Alliance would be happy to help convene discussions about priority areas. Any national-level challenge funds should capitalise on excellence throughout the system, through open competitive processes.

10. Business-university collaboration is critical to a joined-up system, across a range of activities. Amongst others, these include the commercialisation of research, the sharing of science infrastructure, the collaborative development and improvement of technical and business processes, and the creation of new graduate spin outs, as well as ensuring a pipeline of highly skilled workers to meet the needs of our future economy. HEIF is a critical stream of funding for stimulating business-university collaboration, and is currently under-resourced. Other financial support would further incentivise business-university collaboration, including making these interactions VAT-free: the 'third mission' should be counted as a 'primary purpose' for universities.

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[2] Wilson R and A Green (2001) *Projections of Occupations and Qualifications: 2000/2001: Research in Support of the National Skills Taskforce Department for Education and Employment*

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1. Science Investment

Sufficient and long-term commitment to investment

11. The UK science base punches above its weight in terms of efficiency and productivity, and is a major source of economic, social and cultural value for the UK generating substantial returns to public investment–estimated to range between 20% and 50% but often much higher.[3] Substantial value is placed on the knowledge and expertise generated by the UK's publicly-funded university research and researchers – total knowledge exchange investment has risen by 5% over the last year, from £3.4 billion in 2011-12 to £3.6 billion in 2012-13.[4] Universities carry out 74.3% of publicly-funded Gross Expenditure on Research and Development (GERD) and 26.5% of total GERD – significantly above OECD average.[5]

12. However, the UK's investment in R&D and innovation is also well below average compared to competing nations and significantly lower than OECD and EU averages, at the same time as new and emerging economies are investing heavily in science and research.[6] Areas of our overall innovation performance lags behind many of our key competitors, as outlined below.

13. To achieve economic prosperity by means of the knowledge economy, research and innovation activities need sufficient and sustained funding. **We therefore welcome the One Nation principle of long-term certainty on investment in research – this requires both protection of the science budget and commitment to inflation in real terms**. This will be essential for the science base to maintain its vitality and excellence, allowing it to drive economic growth, respond to business needs, solve tomorrow's problems today and remain the primary choice for partners from across the globe.

Funding excellence wherever it is found drives quality

14. Quality is key to the UK's world-leading research reputation, and excellence is found across the UK higher education sector. The diversity of our world leading research base (the UK boasts internationally recognised research strengths in over 400 fields) sustains and supports our international competitiveness, capitalising on the spread of excellence.

15. The evidence for the benefits of funding excellence wherever it exists is well established,[7] and this principle is an important pillar of the UK's funding system for

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[3] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[4] HE-BCI data.
[5] UUK (2014). *Higher Education in Focus 2014: Research and postgraduate research training. London: UUK*, pp. 6-7.
[6] Rt. Hon Liam Byrne MP (June 2014). *Agenda 2030: One Nation. Labour's Plan for Science* (Green Paper); T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[7] L. Aston and L. Shutt (2009). *Concentration and diversity: understanding the relationship between excellence, concentration and critical mass in UK research.* University Alliance and Evidence Ltd

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research. Public research funding should continue to be selectively distributed based on excellence, in order to continue to drive the quality and impact of UK research and to secure the future health of the UK research base. In a difficult fiscal environment it is essential that these existing principles are maintained because they have been proven to maximise the return from limited public investment.[8]

Dual support and autonomy are essential

16. Predicting future market changes and grand social and scientific challenges is an inexact science, especially given the pace of progress, and we need to make sure we are future proofing, by allowing growth sectors and niche research (any of which is potentially critical to tomorrow) to thrive.

17. This is why the dual funding system for research, which includes the flexibility for universities to invest in new areas of research and maximise investment opportunities, remains critical to the dynamism and responsiveness of UK research and has been proven to drive quality. The autonomy of institutions has been shown to have a direct correlation with the quality of a system, with the UK recognised as being distinct in both its level of autonomy and its quality.[9] Autonomy remains key to the approach adopted in Alliance universities allowing them to manage their position within various markets, operate flexibly in response to drivers and opportunities, be responsive to both threats and opportunities and to focus resource on their key strengths within an increasingly dynamic higher education environment.[10]

How can we make better use of the UK's resources to support science and innovation?

Efficiencies and excellence through collaboration

18. Connectivity, collaboration and openness will be essential to the future of world-leading science – the so-called 'Science 2.0'. Collaboration based on specialised excellence is key to a successful and efficient research ecosystem, brining cost savings as well as other benefits of collaborative working.

19. Universities have proven that they are keen and willing to work together and to share resources where possible to maximise the national significance of the products of public funds, in all types of all assets (including data and even 'shelved' IP). Good progress is being made towards a more efficient system following the Wakeham and Diamond reviews, although there is still more to be done.[11]

(2011). *Funding research excellence: research group size, critical mass & performance.* University Alliance.

[8] www.rae.ac.uk/Pubs/2004/01/rae0401.doc

[9] P. Aghion et al (2008). *Higher aspirations: An agenda for reforming European universities*. Bruegel Blueprint Series, V.

[10] L. Aston & L. Shutt (2010). *Efficiency, leadership & partnership: an approach that delivers shared economic priorities*. University Alliance.

[11] W. Wakeham (2010), *Financial Sustainability and Efficiency in Full Economic Costing of Research in UK Higher Education Institutions*; I. Diamond (2011). *Efficiency and Effectiveness in Higher Education*.

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20. A good example of this is through asset sharing agreements, although these are not yet comprehensive and in many cases Alliance universities report difficulties in accessing existing networks. **University Alliance** is acting collectively to extend these benefits and efficiencies more widely over the next year, to involve universities and businesses across the country, which will involve an audit of current capabilities. It may be helpful to extend an audit of current sharing capabilities across the entire sector. Alliance universities are already involved in some sharing agreements in specific areas/assets, for example:

    a. The **University of Portsmouth** is part of the South-East Physics Network (SEPnet), an alliance of ten physics departments across the south of England focused on sharing research, teaching and outreach resources to maximise the benefit for all members.[12] The SEPNET Computing Infrastructure for Astrophysical Modelling and Analysis (SCIAMA) supercomputer[13] is at the heart of the University of Portsmouth's Institute of Cosmology and Gravitation (ICG) providing researchers access to state-of-the-art high performance and high throughput computing to model and analyse complex behaviour in a number of scientific areas. Although mostly funded by SRIF funding to the University of Portsmouth, over 30% of the computing time on the £350k SCIAMA-I supercomputer goes to other SEPnet partners. The £600k SCIAMA-II is due this month, funded by a mixture of RCIF and university money. Another shared SEPnet facility at Portsmouth is the Low Frequency Array (LOFAR)[14] telescope, now funded by STFC.

    b. **Oxford Brookes University** holds a new £1 million Zeiss 3D scanning electron microscope – currently the best in the UK – which is regionally shared (with the University of Oxford). Following original funding from BBSRC, Oxford Brookes are developing plans to build a new lab around the microscope to improve performance and researcher accessibility.

    c. **Manchester Metropolitan University** (MMU) has assembled a unique aircraft exhaust measurement facility (Alfa) with the Universities of Sheffield and Manchester. The joint facility comprises: a gas and aerosol-sampling rake capable of traversing the core of the aircraft plume; high-resolution time of flight Mass Spectrometer (WToFMS) system for incorporation into an existing Aerodyne Aerosol Mass Spectrometer (AMS) at the University of Manchester; and a fully equipped mobile combustion laboratory at the University of Sheffield. Elements of the Alfa joint facility have been used by the three partners in a number of programmes. These include work for Shell and Rolls Royce on aircraft engine exhaust emissions composition.

21. Accessibility and collaboration both with other university partners and with industry is essential to the missions of Alliance universities. Examples of strategic industry collaborations resulting in significant research and innovation assets are:

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[12] www.sepnet.ac.uk
[13] www.sciama.icg.port.ac.uk/sciama%20ack.htm
[14] www.lofar-uk.org

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a. The collaboration of **Siemens** with the **University of Lincoln** in a £37.5M joint venture, resulting in the building of a new Engineering School[15] and generating a wide portfolio of research projects (over £2M since 2010) with immediate commercial benefit, retention of over 1,000 jobs in the UK and further expansion of Siemens' business in the Lincoln area. The strategic partnership leveraged £500K investment and a 10-year lease on space from Siemens, underpinning the sustainability of the build and the assets in it. Furthermore, through the partnership Lincoln has access to the turbines that Siemens locate within their workshop for training and development, alongside all the control kit. The collaboration brought in a further £3.2M of public grant, £1.8M ERDF and £1.4M Single Programme funding. The School and the activity around it underpins the Greater Lincolnshire LEP's focus on Engineering as a priority sector for the area.

b. **Coventry University** and the Unipart Group have joined forces to develop a new Engineering and Manufacturing Institute on Unipart's manufacturing site in Coventry.[16] The £32 million project will see the creation of an international centre of engineering and manufacturing excellence, which will be the base for a sustained programme of innovative research activity, teaching and learning, and product development. The project has been awarded £7.9 million from the Catalyst Fund. Unipart itself is contributing £17.9 million towards the creation of the new facility, with a further £5.6 million towards student scholarships and product research and development, and including support for the new undergraduate and postgraduate programmes in manufacturing and the advanced engineering and management programmes that will emerge as a result of the initiative. This collaborative project establishes a sustainable research partnership integrated with a new and innovative teaching environment that will create a step change in the higher education model for manufacturing engineering degree courses through enhanced activity-led learning.

22. Connectivity and collaboration therefore need to be embedded within the focus and approach of national-level funded projects, which need to be shared and accessible to all in the ecosystem.

23. University Alliance also supports new initiatives by the Technology Strategy Board and National Centre for Universities and Business (NCUB) – to develop national brokerage systems to improve connectivity within the research and innovation ecosystem. These will help integrate and connect different actors within the research and innovation ecosystem and help direct access to relevant equipment, data and research, as well as business expertise – to help translate the cutting edge science into real world innovations.

[15] www.lincoln.ac.uk/home/engineering/

[16] www.unipart.co.uk/UserFiles/File/Coventry%20University%20Joins%20Forces%20With%20Unipart.pdf

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Optimise the existing research and innovation ecosystem with open competition

24. Universities are the largest research provider in the UK, and play a key role of the research and innovation ecosystem. Open innovation requires open competition, however. The evidence for funding excellence wherever it exists is well established[17] and this principle is an important pillar of the UK's dual funding system for research. The UK should continue its policy of selectively distributing research funding, based on quality, in order to continue to drive the quality and impact of UK research and secure the future health of the UK research base. In a difficult fiscal environment it is essential that these existing principles are maintained because they have "enabled the Government and funding bodies to maximise the return from the limited public funds available for … research".[18]

25. However, there are examples of public funding streams where these principles are not being followed, particularly around doctoral training – with implications for the future workforce and skills base. Research Council policy to fund 'fewer, larger, longer awards' in response to efficiency pressures has meant that some important funding streams supporting postgraduates and knowledge exchange activities are no longer open to all HE Research Institutions. Concerns and the implications of uncompetitive funding for doctoral students are outlined further below under 'Section 3: The Rungs on the Ladder'.

26. Another example of uncompetitive funding is Impact Acceleration Accounts (IAAs), which some Research Councils have allocated 'based on the size of Research Organisations' recent research funding history'.[19] Calculating eligibility by previous funding allocation within a Research Council context is misleading, as it does not reflect excellence in a diversity of research activities – an open competition for IAAs would recognise excellence throughout the system in realising impact in research.

How can we unlock greater levels of private sector investment?

Increase investment in innovation schemes with proven success

27. To achieve economic prosperity by means of the knowledge economy, research and innovation activities need sufficient and sustained funding – leverage is key to maximising the benefits of public investment. There is strong evidence that increasing public investment also increases private investment in R&D (where the UK is weak) – for every £1 spent by the government on R&D, private sector R&D output rises by 20p per

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[17] L. Aston and L. Shutt (2009). *Concentration and diversity: understanding the relationship between excellence, concentration and critical mass in UK research.* University Alliance and Evidence Ltd (2011). *Funding research excellence: research group size, critical mass & performance.* University Alliance

[18] www.rae.ac.uk/Pubs/2004/01/rae0401.doc

[19] http://www.esrc.ac.uk/collaboration/knowledge-exchange/opportunities/ImpactAccelerationAccounts.aspx

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year in perpetuity.[20] By failing to invest sufficiently, we are not maximizing the leverage of private investment.

28. A full range of industrial partners of all sizes should be given the opportunity to match their resources to public funds: currently this is not always the case (as with the restriction of iCASE industry partners mentioned below in 'Section 3: The Rungs on the Ladder'; and the high (£10 million) threshold for the Research Partnership Investment Fund), which demonstrates a missed opportunity to bring in funds from smaller but rapidly innovating business partners.

29. There is evidence for high-performing investment programmes which successfully leverage private funds, including HEIF and KTPs. These should be prioritised in any future science strategy.

Invest more in HEIF to leverage funds and innovative capacity from SMEs

30. The UK has a well-performing university-business interface. However, there is a need to increase the innovative capacity of SMEs. SMEs are the driving force of innovation in the UK economy. Innovation was responsible for two-thirds of productivity growth between 2000 and 2007. It was the common defining feature of the fastest growing 6% of businesses between 2002 -2008. These businesses generated half of all new jobs created during this time and were predominantly SMEs.[21] The UK's innovation performance as measured by the Innovation Union Scoreboard showed a marked increase thanks to increases in innovative SMEs collaborating with others during 2009 and 2010.[22]

31. Nevertheless, SME spend on innovation is low. The research base and anchor institutions have an important role to play in increasing the innovative capacity and investment of SME private funds in research and development.[23] The examples cited below demonstrate how Alliance universities' connectivity and expertise are driving economic growth through increasing local SME innovativeness and investment in R&D.

32. Innovation activities are a part of core business for many universities. Nevertheless, if the 'third mission' is to be realised fully, funding to support these activities, especially costly activities with SMEs, needs to be brought more closely into line with that for the other core missions: research and teaching. As Figure 1 shows, HEIF is currently significantly under-funded.

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[20] J. Haskel, A. Hughes and E. Bascavusoglu-Moreau (2014). *The Economic Significance of the UK Science Base*. CaSE.
[21] S. Shanmugalingam et al (2010). *Rebalancing Act.* NESTA.
[22] European Commission (2014). *Innovation Union Scoreboard*, p. 70.
[23] University Alliance (2011). *Growing the future: universities leading, changing and creating the regional economy*

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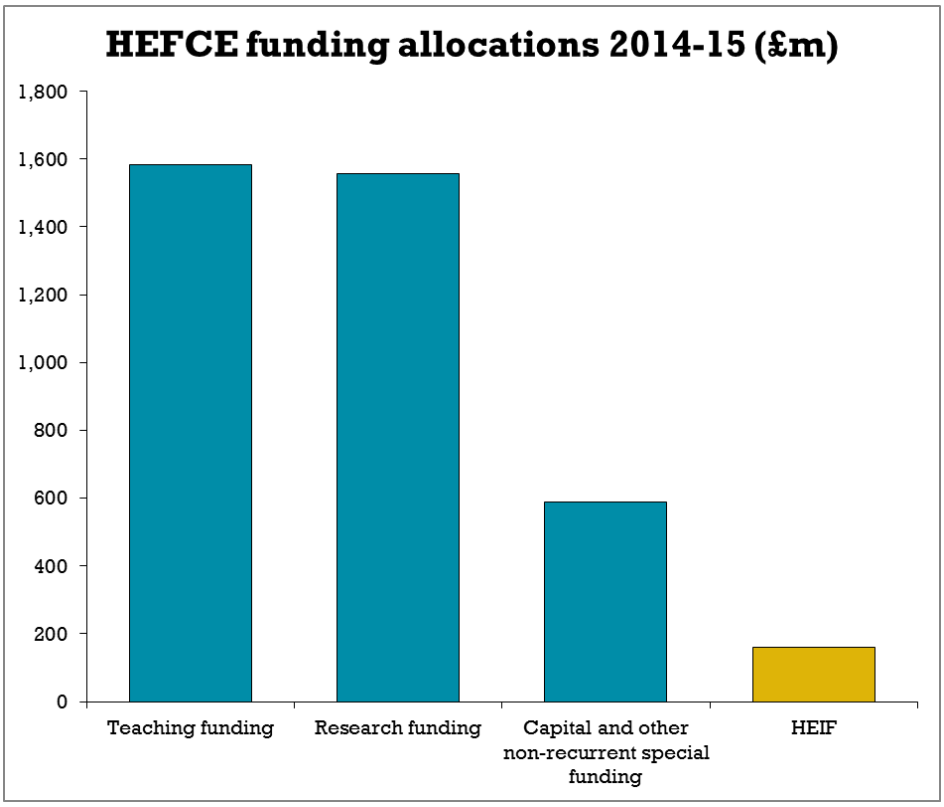

Figure. Source: HEFCE Annual Funding Allocations 2014/15

33. At £160 million HEIF is a relatively small – but critical – stream of funding, and its impact far outweighs its size. As the principal dedicated funding stream that allows universities to work innovatively with local SMEs, HEIF has enabled universities to support innovation in growth sectors and it provides an excellent return on government investment – every pound of HEIF gives a gross return of £6.30 in additional Knowledge Exchange (KE) income, a proxy for the impact on the economy.[24] However, this is likely to represent an underestimate of the total economic and social benefits.

34. Alliance universities have a diverse income portfolio and obtain less than 50% of their income from core public funding. HEIF is a critical funding stream for our universities, which are committed to growing income from private sources to achieve significant impact, working in partnership with business to realise important investment and growth. For example:

    a. **Plymouth University** is using HEIF to multiply the impact of their innovative Growth Acceleration and Investment Network (GAIN) platform. In partnership with the public and private sectors the University connects people, ideas and capital to accelerate the growth, and development of knowledge based businesses. GAIN links

[24] Tomas Coates Ulrichsen (April 2014). *Knowledge Exchange Performance and the Impact of HEIF in the English Higher Education Sector*, Report for HEFCE

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their research and teaching expertise with more than 500 high growth businesses, encompassing 32,000 staff and a turnover of £2.7billion.

b. At the **University of Huddersfield**, 50 per cent of their HEIF allocation has been used to establish a series of initiatives to grow the University's KE and commercialisation activities with external bodies. These key collaborative relationships ultimately lead to long term R&D programmes, delivering income generation and gearing for both partners including a £7.6m partnership with Borg Warner with leveraged RGF and inward investment from Borg Warner's US arm, and a £20m partnership with the Rail Safety and Standards Board. Huddersfield is attracting inward investment and upskilling workforce through strategic collaboration.

c. The **University of Portsmouth** has used HEIF funding to open up the testing facilities within the Institute of Marine Sciences and School of Earth and Environmental Sciences, linking these to businesses through the University's Environment Network, UPEN. It also used HEIF funding to establish the cross-faculty Centre for Operational Research and Logistics, bringing together multidisciplinary research expertise on the science of data and the science of decision making and working with different industrial sectors and academic partners. Recent projects include: an EU-funded project to find ways of more efficiently configuring the supply chain of offshore wind farms in order to reduce the per unit electricity generation costs; working with Xyratex (a manufacturer of large scale network storage solutions and High Performance Computers) to develop predictive maintenance systems for their disk drives and storage solutions, which has led to two US patent applications; and the development of a Virtual Engineer – a maintenance and operational management programme for future food packaging with Stork Food and Dairy Systems.

35. Without the steady income stream through HEIF universities would have to scale back this activity, affecting businesses and the economy locally and regionally. Cuts to HEIF would have detrimental effects to SME growth and innovation, new business formation, job creation, commercialisation of research and product to market activity across the UK.

36. To ensure improving returns on HEIF funding, we need to ensure that HEIF allocations are calculated according to its key objectives. The formula for HEIF does not currently recognise the full range of innovation activity. HEIF needs to incentivise universities to continually improve their contribution to innovation and growth, particularly through their work with SMEs.

37. HEIF currently double weights university interactions with SMEs. This weighting should be increased both to incentivise this activity but also to recognise the larger resource required to facilitate interactions with larger numbers of SME partners. High levels of engagement and innovation with SMEs do not necessarily translate into high levels of HE-BCI investment. Some measure of levels of SME engagement in quantity (rather than straight econometrics) and scaling – given that this is a policy priority at all levels – would be extremely useful and a strong indicator of how universities are actively engaging with LEP and local growth agendas.

38. Reforming the calculation of HEIF to also recognise success in improving returns on HEIF funding, the creation of graduate spin-out companies, and other SME activities with significant local impact, will ensure that universities develop fundamental, long-term

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and sustainable commitments to driving growth through SMEs. University-led growth will also drive improvement in regions which currently underperform in innovation, and lead to more equally-distributed growth across the UK.

Support and extend the successful KTP system

39. Knowledge Transfer Partnerships (KTPs) have a proven track-record in delivering economic growth on the back of Government investment and are widely considered to be effective and productive means for knowledge exchange. They have enabled critical business engagement to develop knowledge, commercialise innovation and power new industries. They allow businesses to build capacity and capability exploit their potential and obtain a return on the investment in publicly funded research.

40. The centrality of research to KTPs is key to their success. However, innovation for many SMEs is not necessarily driven by pure research. A wider recognition and definition of what innovation means and different forms of research would help more SMEs to engage, as Teesside University's Knowledge Exchange model, supported through ERDF, has shown.[25] More promotion of the KTP model and benefits would help widen its take-up amongst SMEs.

41. Greater flexibility in the scheme would allow universities and business partners to adapt the programme to specific needs, including around researcher development. For example, short KTPs have a very useful place in the scheme – they are an excellent way for students to gain post-graduation commercial experience as well as providing smaller firms with incentives to employ graduates. There should also be an option to lengthen some KTPs to enable a student to both register for and complete a higher degree, preferably a PhD.

42. A framework that enables groups of smaller firms to come together to undertake jointly sponsored KTPs could also increase SME engagement. In the initial phase this could be tested through European funding bids, in light of the Horizon2020 emphasis on SMEs.

Strengthening and developing the key role of the Technology Strategy Board

43. The Technology Strategy Board is a well-established and proven support system for securing commercial benefits derived from university research and other activities, with effective mechanisms including innovation vouchers, Knowledge Transfer Partnerships and the Catapult Centres. We would strongly recommend that these mechanisms not be replicated in new support systems, rather more be made of the Technology Strategy Board by strengthening its funding and ability to support research and innovation by the proposals here.

[25] http://www.tees.ac.uk/sections/business/KEI.cfm

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Successful models and characteristics of support

44. Evidence suggests that the human factor is crucial in helping with absorptive capacity and knowledge exchange,[26] and therefore support systems that promote the movement of people between industry and academic environments are to be encouraged.

45. Strong links with business and industry are a central focus of Alliance universities. They have found that the most successful approach is one where business links and engagement are embedded across a range of university activities, not least through their staff who have a powerful combination of industry and academic experience. Alliance universities work closely with employers to provide over 50% of year-long work placements and lead over one-third of all UK knowledge transfer partnerships. By operating a 'revolving door' attitude towards business, staff and students are encouraged to move between both throughout their careers.

[26] D. Tzabbar, B. S. Aharonson, and T. L. Amburgey (March 2013)."When Does Tapping External Sources of Knowledge Result in Knowledge Integration?," *Research Policy* 42, no. 2, pp. 481–494, doi:10.1016/j.respol.2012.07.007; Vitae, RCUK, and CBI, *The Future of the UK Research Base and Implications for the Professional and Career Development of Researchers*; H. Bakhshi, P. Schneider and C. Walker (2008), *Arts and Humanities Research and Innovation*. AHRC and NESTA.

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2. Strengthening British science

From ideas to application: supporting innovation through university-business collaboration

46. UK higher education institutions are the central pillar of publicly-funded national R&D and essential to the UK R&D base as a whole, carrying out 74.3% of publicly-funded Gross Expenditure on Research and Development (GERD) and 26.5% of total GERD (significantly above OECD average).[27] There is strong evidence that increasing public investment also increases private investment in R&D (where the UK is weak) – for every £1 spent by the government on R&D, private sector R&D output rises by 20p per year in perpetuity.[28] In a tight fiscal environment, investments must be certain to reap public benefit and therefore the leverage of private investment through our world-class Higher Education system is the best route for providing value for money for public funding.

47. The UK performs well in international comparisons of business-university collaboration. UK has ranked 2nd for university-business collaboration in the annual Global Innovation Index for the last two years.[29] According to the World Bank, the UK remains the best place to do business in the EU and the G8. The 2011 European Cities Monitor[30], where 500 business leaders were surveyed, found that some of the most important features for business location decisions included education, highly skilled labour and technology infrastructure.

48. The UK needs to be proactive in maintaining its status as a leading innovative economy. Other countries are making business-university collaboration a priority. A dominant theme emerging from workshops in Vietnam and Indonesia that University Alliance has recently undertaken with the British Council showed that this is a top priority for these emerging economies, both in employability and research agendas. Other developed economies are also making concerted efforts to improve in this area, including Australia, who are looking to the UK to learn lessons.

49. Alliance universities are already ensuring their research and expertise, including significant capital research assets, are available and productive for a wider cohort of users, including industry of all sizes. In addition to strategic partnerships with large businesses, they are supporting small and rapidly innovating businesses with research and development. SMEs need support to increase R&D investments, which lag behind international comparators. Opening university research facilities to these businesses is an essential element in the integration of the research and innovation ecosystem and realising the benefits of the UK's world-leading research environment.

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[27] UUK (2014). *Higher Education in Focus 2014: Research and postgraduate research training. London: UUK*, pp. 6-7.
[28] J. Haskel, A. Hughes and E. Bascavusoglu-Moreau (2014). *The Economic Significance of the UK Science Base* (CaSE)
[29] http://www.globalinnovationindex.org/
[30] Cushman & Wakefield (2011) *European Cities Monitor 2011*

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Recognition of the key translation and development role of universities in innovation

50. We welcome the increasing recognition of the diversity and complexity of the role of universities in the UK's innovation system, and the emphasis on co-creative activities in an 'open innovation' environment. This more nuanced understanding of the processes, feedback loops better appreciates the range of activities that are involved in innovation including the full spectrum of university research from basic to applied. As Labour develops its Science Strategy this perspective should help ensure that activities at all stages of the innovation process are incentivised and supported.

51. Many international comparators show the UK is successful at innovation and connectivity. It is ranked third behind Switzerland and Sweden in the 2013 Global Innovation Index, and tends to perform particularly well on business-university collaboration indicators (as outlined above). For other parts of the innovation system, however, the UK performs less well comparatively. The European Commission's Innovation Union Scoreboard measures whole system performance in innovation, and the UK is defined as an 'innovation follower' – ranking eighth out of all members states (ninth across Europe including non-members) and lying outside of the top group of 'innovation leaders' (Sweden, Germany, Denmark and Finland). The UK's growth performance is the second lowest at only 0.5% – well below the EU average of 3.7%. Over time, innovation performance among Member States is converging, and the UK must make efforts to maintain and improve its innovation performance.

52. The Innovation Union Scoreboard shows that the UK is performing relatively well (and is growing) in terms of the 'Enablers' indicators – that is to say research base and research-business interfaces, but there are challenges according to indicators measuring rates of firms involved in innovation activities – ranking 21st, 'intellectual assets' (ranked twelfth) and 'firm investments' (seventh) – with relatively weak performance and declines in growth amongst 'sales share of new innovations' and 'SMEs with product and/or process innovations'. Tera Allas's report marked out similar weaknesses in the system.

53. There is a role for universities to play here, particularly around increasing the innovation capacity of SMEs and increasing the domestic talent supply of graduates and research postgraduates to exploit science and innovation. There are also challenges around recognising co-creation of knowledge activities and the encouragement of public-private co-authored papers. Throughout this response we have offered recommendations for increasing the performance against these indicators, particularly around HEI's support of SME innovation and the talent base.

54. We support the development and use of more sophisticated indicators that better capture the impact of universities' innovation activities.

Placing science at the heart of government and policy making

55. Science must be at the heart of central government and policy making decisions, including a commitment to departmental R&D budgets. Analysis suggests that use of

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alternative research providers differs widely between departments, which to some extent reflects different sectoral supply issues.[31] However, there is a strong case to be made for looking more closely at how government R&D spending is channelled, and whether best use is being made of the excellent research that resides in our universities. Issues around procurement, advertisement of opportunities and researcher development could form part of this analysis. **University Alliance** is undertaking work in this area and would be pleased to convene further discussions with key stakeholders.

56. National funds for joined-up big research, around key challenges such as ageing, obesity, environmental sustainability, etc. would drive and focus research efforts. These could be in the form of a No. 10 'Big Challenge' and bids should – as with other large challenge-based schemes, such as Horizon 2020 – require collaborative and multidisciplinary bids. Multi-disciplinary and multi-partner approaches are key to problem-solving and innovation and there is real opportunity for innovation through the constructive tension on the boundaries of disciplines and refreshing research collaborations.

A joined-up approach to science that plans for the world of 2030

57. Economic growth continues to be of critical importance to the UK, and UK science has a central role in delivering the advancements and innovations that will support this growth. National science projects should be prioritised if they are enhancing the UK's existing strengths, and if they are building capability to exploit large international markets. Long-term transparent priorities (such as outlined in a Science Strategy) allow greater complementarity of the research system to these aims.

58. However, funding should also continue to support niche and experimental research at institutional level – abiding by the Haldane Principle – since the flexibility of the research system to respond to new opportunities is key to future-proofing in an uncertain and rapidly moving future.

59. Large scale projects in the national interest should aim both to address fundamental weaknesses in the UK's research and innovation ecosystem. Following a recent benchmarking study, it is evident that the UK's capacity to commercialise research needs to improve, as it is currently lagging behind international competitors.[32] Priorities should expand on our existing research strengths, especially in near-to-market research, and build the UK's capacity to exploit large international markets. Priorities which map on to a defined and long-term strategy (i.e. Industrial Strategy and Great Technologies) are useful for research base to align and complement some of their own resources to achieve national aims.

60. To ensure and to drive quality, all national, large scale capital resources must remain neutral and accessible to the most excellent researchers and innovators within the UK, which will involve a commitment to outreach and autonomy. Furthermore, investments in national capital projects should be balanced with greater funding streams through the

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[31] http://blogs.lse.ac.uk/impactofsocialsciences/2014/03/20/open-data-government-commissioned-research/

[32] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.

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funding and research councils, with a more integrated approach to how those resources are shared and made accessible as part of a truly international infrastructure.

Making the most of connectivity within the system – SMEs

61. Existing capacity, such as exists within Alliance universities which have strong relationships with SMEs in targeted industries and technologies, should be leveraged to increase engagement with this important constituency and to ensure a joined-up ecosystem of research and innovation activities. These institutions are already proving that partnerships with smaller institutions are possible and that excellent research and strong existing university-business relationships are helping to generate business-led innovation. Alliance universities are committed to improving innovation amongst SMEs and are developing mechanisms for sharing resources and capital with businesses.

    a. For example, as part of the **University of Salford** the major research facility in MediaCity UK connects the BBC and the Digital and Creative Industries sector to international academics and industry research specialists with the aim of generating £25m investment in research over the next eight years. Salford also runs the ERDF Energy Hub, a unique project allowing regional SMEs to engage with leading academics and state-of-the art world class facilities, aiming to support 140 regional SMEs in the development of new technology, products and systems that reduce the carbon emissions from existing properties. ERDF funding has allowed the University to build a unique facility, Salford energy house, the world's first and only full size house within a laboratory.

    b. The **University of Portsmouth** shares market intelligence with SMEs and engages in strategic discussions about the big commercial opportunities for innovation and sales and development links to Asia. SMEs also benefit from opportunities to network and present to local business leaders at showcase events around key sector themes such as creative industries, environment, healthcare innovation, high end manufacturing, infrastructure and logistics, and security.

    c. The **University of Plymouth** is harnessing its marine expertise for economic growth through its new Marine Innovation Centre (MarIC), established to optimise the interface between the University and Marine Sector SMEs. The Centre promotes the industrial uptake and commercialisation of the University's research and world-class facilities, links businesses to the Growth Acceleration and Investment Network (GAIN) and improves SME performance by stimulating innovation and the successful exploitation of new ideas. The project has a total cost of £1.97m (of which £880K ERDF) – match-funded by the University – and £200K from industry. The funded period runs from October 2012 to June 2015 by which point the Centre aims to become fully sustainable. MarIC aims to provide 190 business assists over the lifetime of the project and expected results include the creation of 93 new jobs, 41 additional firms involved in business clusters or networks, 37 SMEs launching new or improved products, and 26 gross jobs created in environmental sectors. The project is expected to deliver a gross increase in GVA of £3.726m and a gross safeguarded GVA of £1.674m.

    d. **Teesside University's** Centre for Construction Innovation and Research operates as a high level network resource in the Construction sector (one of the 11 key industries

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in the Industrial Strategy) – a role also recognised by the MD of Niven Architects, a current KTP partner, who cited this as likely to be the most valuable long term benefit of the KTP. The group works with clients involved across all 7 RIBA Plan of Work Stages, and in doing so it is able to foster commercial opportunities and research collaborations between businesses, often acting as the initiator to introduce potential partners.

e. **Coventry University**'s Knowledge Exchange and Enterprise Network (KEEN) is a business improvement programme, part-funded by ERDF, designed to help West Midlands based SMEs increase their profitability and achieve growth. KEEN offers a level of flexibility to companies who are yet to realise their full potential, made possible through the transfer of knowledge into the business via a recent graduate who is recruited to work full-time on a growth project, developed in association with the university, for between 6 to 24 months. Two examples of **Coventry University**'s successes using ERDF funds to help SMEs innovate and raise the innovation capacity of their local environment are citied in the recent European University Association report on universities and smart specialisation.[33]

62. University Alliance welcomes the activities of facilitating bodies – in particular new initiatives by the Technology Strategy Board and NCUB – to develop brokerage systems which are helping SMEs get the most out of our research and innovation ecosystem, including access to equipment as well as research and business expertise.

Capitalising on the vital role of the business-university interface

63. The UK performs well in international comparisons of business-university collaboration. UK has ranked second for university-business collaboration in the annual Global Innovation Index for the last two years.[34] According to the World Bank, the UK remains the best place to do business in the EU and the G8. The 2011 European Cities Monitor,[35] where 500 business leaders were surveyed, found that some of the most important features for business location decisions included education, highly skilled labour and technology infrastructure.

64. It is not only in technology where University research helps businesses innovate, but in processes and services. Among others, the **University of Salford**'s KTPs provide many examples of this, including innovations in processes at Dyer Environmental Controls, Create Construction and Moneyline; and services innovations at Brook Manchester, Moneyline, and Greater Manchester Fire and Rescue Service.[36]

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[33] European University Association (2014). *Report on Joint EUA-REGIO/JRC Smart Specialisation Platform Expert Workshop: The Role of Universities in Smart Specialisation Strategies*, pp. 29-30.
[34] http://www.globalinnovationindex.org/
[35] Cushman & Wakefield (2011). *European Cities Monitor 2011*
[36] More details can be found at http://www.salford.ac.uk/__data/assets/pdf_file/0008/224999/KTP-Publication-Final.pdf

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Universities are anchors for joined-up science policy and local growth

65. Universities have a significant and unique role to play as leaders within their localities. As anchor institutions they are often the only institutions with the continuity, scale and local connectedness to drive economic growth and shape the physical environment. LEPs can harness this leadership role by capitalising on individual universities' links and networks with other local players and businesses, and universities are heavily involved in LEPs across the country. Alliance universities have been in the business of meeting local economic need for over 100 years, many being established during the industrial revolution to meet the demands of the then new industries. They very often have a deep understanding of the industrial and commercial strengths of the region as a result of their close links with business.

66. In their 2012 review of LEP area economies, the LEP Network,[37] found that the highest performing and significantly improving LEP areas have high levels of employment and productivity, based on competition, enterprise, innovation, investment and skills. University personnel in some LEPs have been centrally involved in the development of Strategic Economic Plans and ESIF strategies. Alliance universities are reporting high levels of convergence with LEP innovations strategies in Strategic Economic Plans. Universities should continue to be encouraged to co-develop skills strategies. Universities are also well placed to facilitate LEP collaborations across regional boundaries, enabling businesses and universities to construct the infrastructure in which both enterprises can flourish.

    a. Both **Oxford Brookes University** and the University of Oxford have been working very closely with the Oxfordshire LEP during negotiations for the Oxford City Deal, the SEP (Strategic Economic Plan) and the ESIF (European Structural Fund) distribution. A key part of the LEP's innovation strategy involves ESF and ERDF money and a board (involving university personnel) will distribute funds once they have been released.

    b. The **University of Salford** is heavily involved with the Greater Manchester LEP, and has supported the development of the GM LEP strategy. The University also has representatives sitting on key boards within the LEP, including Low Carbon, which is fundamental in ensuring that the University is engaged and driving the innovation within GM low carbon and energy sector. The University is also very well connected and works with key organisation that supports the LEP, including UKTI Northwest, MIDAS – Greater Manchester's Inward Investment Organisation, Greater Manchester India Steering group and Greater Manchester China Forum. To support this engagement with both the public and private sector organisations, Salford has adopted a key account management approach to ensure that their relationships with SME community add value and deliver what industry wants, when.

    c. **Teesside University** works very closely with the LEP and is represented on the Tees Valley LEP Board, the Tees Valley Economic Development Group, the Tees Valley Innovation Leadership Group and the Tees Valley Employment Learning and Skills Group. The Tees Valley LEP innovation strategy is being developed, and the

[37] www.lepnetwork.org.uk

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University will link to this based on the main Tees Valley sectors – the process industry, advanced manufacturing, digital and health. The University's relevant expertise includes generating energy from waste materials, engineering expertise in oil and gas, environmentally friendly chemistry, biologics, engineering expertise applied to the automotive, aerospace and steel sectors, and visualisation technologies (including for non-digital sectors). A range of the University's business engagement and research activities are relevant – including collaborative research projects with industry based on their needs, innovation support and training provision (both scientific and management).

67. Universities are ideally placed as regional hubs for enterprise. While London and the South East are often perceived to be a magnet for businesses and talent, our universities and their student networks are enabling graduates to start and grow their businesses in every region across the UK – drawing on their connections with their local community.

    a. The **University of Lincoln**'s £37.5M collaborative venture with Siemens and their supply chain demonstrates the large financial benefits of a university-coordinated strategy with local and industry partners. The partnership resulted in the building of a new Engineering School, generated a wide portfolio of research projects (over £2M since 2010) with immediate commercial benefit, retention of over 1,000 jobs in the UK and further expansion of Siemens' business with the creation of a further 50 jobs. As well as leveraging investment from Siemens, the collaboration brought in £3.2M of public grant, £1.8M ERDF and £1.4M Single Programme funding. The School and the activity around it underpins the Greater Lincolnshire LEP's focus on Engineering as a priority sector for the area. It also provides a critical conduit to draw in TSB funding to businesses throughout the supply chain. Beyond the key strategic partnership with Siemens, the Engineering School has already engaged with over 400 engineering businesses and organisations – undertaking commissioned research (including with Marks & Spencer and Mitsubishi), Knowledge Transfer Partnerships, and access to part-time degrees (income totalling £1.6M in the first 3 years and growing rapidly). The school is actively driving local and regional cluster event activities (e.g. IMECHE, IET and the Institutes of Physics and Combustion) and leveraging investment through a portfolio of European-funded projects on aircraft and airport energy technologies.

68. Many universities are already actively involved in the development of (non-University) Enterprise Zones. Physical proximity encourages the integration of researchers and businesses, developed in harmony with local economic strategy. The University Enterprise Zone (UEZ) scheme, which supports capital investment and the development of strong local partnerships between universities, LEPs and other partners extends some of the benefits of these and provides a useful test bed for formalising this relationship. Alliance universities are central to the successful bids in Bristol (led by the **University of the West of England**, with the University of Bristol), Liverpool (**Liverpool John Moores University** joint with the University of Liverpool) and Bradford (a digital health zone led by the **University of Bradford**). The pilot stage of the scheme was limited with eligibility restricted to the 8 Core Cities. We would hope that this scheme would be extended in the future across the whole country.

69. Tax incentives could be used to encourage university-business collaboration further, including simplification and clarity around the VAT rules for businesses and universities

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to co-locate – clarity in explanation and implementation. Enterprise Zone tax benefits (exemption on business rates in first 5 years) should be applied to Innovation Centres where fledgling innovative businesses with university support are seeking to grow. Businesses in these Centres are usually not resident for longer than 3 years. Finally, since innovation activities are part of universities' 'third mission', they should be counted as 'primary purpose' (and therefore be VAT-free).

To achieve success, national networks and resources must be open to the best

70. Where national and international-level investments are made, the results must be neutral and seek to work with – and be accessible by – excellent researchers and research teams throughout the UK's research and innovation ecosystem, wherever this excellence is found. Through this collaborative and excellence-seeking approach, resources will be shared for maximum economic benefit and be able to respond flexibly and innovatively to the great challenges of our day and those of the future. Allocations should seek to fund excellence through rigorous peer-review evaluation processes, and allow institutions to invest strategically both in longer-term and in response to opportunities.

71. We continue to support the Catapult Centre model of business-university collaboration as it develops and grows. To ensure that centres are recognised as a mark of excellence, to achieve world-leading innovation, and to achieve maximum economic benefit, existing Catapults must seek to incorporate the best research and researchers and therefore ensure that any single geographical 'hub' has well-established links with pockets of genuine research excellence across the UK. The open bidding process for university partners used by the Transport Catapult Centre should be adopted by the other Centres, which have previously been relatively difficult to access for many academic partners during their start-up phase. This has created barriers to entry for those that may have relevant expertise in specialist areas. The Catapult Centres must maintain clear entry routes, including easily-identifiable points of contact for both academic and SME partners, if they are to achieve their objective as neutral and joined-up spaces for national benefit.

72. This includes excellence in working with SMEs. Existing partnerships, capacities and networks based in universities should be leveraged by Catapult centres to access SMEs and engage them further with capacity-building. By identifying strengths across the system including in SME engagement, Catapult centres could improve this area of their interaction with business, achieving high impact in a shorter time than acting alone.

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3. The Rungs on the Ladder

What additional policy measures are needed to ensure the UK has a strong pipeline of STEM skills?

73. The hourglass shape of the UK labour market is increasing the need for the attributes and capabilities that graduates bring to the workforce, and economic indicators looking at the levels of graduate saturation have not been exceeded.[38] With 80% of new jobs in high-skill areas it is vital that we have a system that enables all those who have the ambition and ability to succeed at university to do so.

74. The UK's great strength is the diversity of its Higher Education offer to students, and we need to be wary of risking this diversity by creating artificial barriers between Further Education and Higher Education. A strategic partnership model with HE is the best approach (supported by research from BIS[39] on FE and HE preferences) – a partnership model creates and supports progression opportunities, which are essential in an hourglass economy. In addition, we must not look at FE/skills in silos – we must address schools and the academic end of HE as well. Meaningful employer engagement is developed over time by building a relationship, something it is difficult to artificially replicate,[40] therefore the partnership model using existing networks and relationships remains the best model. Alliance Universities are already working innovatively with partners in their area to deliver industry-relevant courses and create genuine progression routes for students and graduates:

    a. At **Coventry University**, first year University College students gain the flexibility to begin an HND and then continue onto that HND or progress to a full degree course. The University is a sponsor and active partner for two Academies in the most deprived areas of Coventry City and North Warwickshire respectively, and has representation on the Boards of several Trust Schools in Coventry as well as being a member of Coventry City's 14 -25 years Partnership which fosters collaboration between all public sectors, the voluntary sector and other key stakeholders.

    b. **Oxford Brookes University** operates a partnership with 7 FE colleges covering a broad geographical region. The partnership is deliberately small so that relationships can be developed more deeply, including networks of support services, libraries, marketing etc. An example of the courses offered includes a Foundation Degree in Policing, a programme that is run with Thames Valley Police and recruits nationally.

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[38] L. Hackett, L. Shutt and N. Maclachlan (2012). *The way we'll work: Labour market trends and preparing for the hourglass*. University Alliance.

[39] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32425/12-905-understanding-higher-education-in-further-education-colleges.pdf

[40] University Alliance (2014). *Job Ready: Universities, employers and students creating success*.

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c. **Teesside University** works with 17 FE colleges in North East and Yorkshire and Humber regions to support progression routes and enhance their offer to students.

d. Marine Academy Plymouth is the UK's first Marine Academy; it's a state-funded specialist secondary school with three sponsors who are the **Plymouth University**, Cornwall College and Plymouth City Council. The focus of the Academy is to help to prepare and develop the students' career opportunities – for today's traditional jobs and for those that we don't yet know about; we will achieve this through a commitment to high standards and to sustainability. Since commencing operations the Academy has transformed its student outcomes.

e. As part of their longstanding relationship with Network Rail, in 2013 **Sheffield Hallam University** launched the Star Track scheme that offers 20 school leavers each year a two-year foundation degree in railway engineering. It combines on-the-job training and classroom-based learning. Doncaster is shortlisted as one of the final bids for the new national High Speed Rail College. The University regards this as an opportunity to make the Sheffield city region a leader in rail engineering skills.

f. Network75 at the **University of South Wales** is a combined work and study route to a degree. Undergraduates apply their academic knowledge to real-life work within a host company. During term-time, students work in a local business three days per week and attend university two days per week. Students also work full-time at their host company throughout holiday periods. There are currently 33 companies participating in Network75, the companies vary in size and industry and are spread geographically around South and West Wales. Some of our current companies include GE Aviation, Premier Foods, Capita, Monmouthshire Building Society, SPTS, JW & E Morris & Barrett Homes.

g. Mechanical Engineering at **Lincoln University** was set up in collaboration with Siemens and enjoys substantial interaction with industry. Their motto is "Industry Ready Students" – this means our graduates aspire to become professional engineers, capable of making a rapid transition to the global industrial environment. The course is accredited by the Institution of Mechanical Engineers and has won several awards including the 2011 Lord Stafford Award for Industry Engagement, and the 2012 Times Higher Education Award for Outstanding Employer Engagement.

h. Business Management (in-company) students at **Nottingham Trent University** gain a degree in three years which includes two years credible work experience. The course includes a 2-year work placement and on successful completion of the course students will also receive a Level 7 Diploma from the Chartered Management Institute (CMI). The main sponsoring companies for this course are Barclays, Rolls Royce, Tesco, Toyota, Zenith Hygiene. 100% of students were satisfied with their course (National Student Survey 2013). 100% of students were employed or in further education six months after graduating (DLHE Survey 2011-12).

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Good business-university collaboration is producing job ready graduates

75. Despite a persistent and dominant public narrative to the contrary, universities are delivering high-quality job ready graduates for businesses of all sizes. They are achieving this through strong institutional-level partnerships which engage employers and universities across a range of activities. University Alliance's report *Job Ready: Universities, Employers and Students Creating Success* collects compelling evidence from employers' perspectives whose graduate recruits are central to their innovation capability.[41]

76. Many organisations lack the capacity or 'organisational slack' for innovation and therefore funding to support undergraduates, graduates and postgraduates into businesses should be available at all levels. **Nottingham Trent University** is placing over 300 graduates into SMEs, some benefitting from financial support through ERDF, but demand is currently outstripping funding.

77. Enterprise culture should be embedded across universities, including within postgraduate degrees. Vitae's 2013 report *What do Researchers Do?* suggests that 'doctoral degree experience seems to prepare [PhDs] better for employment than for self-employment or entrepreneurship'. Only 5% doctoral graduates are self-employed three and a half years after graduation, a lower figure than Masters and good first degree holders (8% and 9% respectively). However, 52% have considered self-employment or setting up their own business.[42] Alliance Universities have a strong track record of nurturing graduate entrepreneurialism – 46% of all turnover from graduate spin-outs comes from Alliance universities – and we would be pleased to convene best practice workshops in developing graduate and postgraduate entrepreneurialism.

High level skills, postgraduates and future innovators

78. As the *One Nation: Labour's Plan for Science* report recognises, it is essential to ensure that investment in science includes sufficient investment in human capital. This is vital if we are to exploit and progress scientific and innovation developments, not only in historic strength areas but in niche and novel research areas which often require an element of risk. This requires a commitment to developing an appropriately-skilled workforce and the researchers and innovators of the future.

79. High-level skills are a vital component of our future growth but they are also central to the process of innovation and renewal in the key sectors of our knowledge-based economy. Safeguarding the future pipeline of skills is therefore essential to the future success of the UK economy. Yet there has been a steady drop in taught postgraduates (PGT) in the last two years, falling by 11%. The proportion of home PGT students is also falling within this, representing only 64% of the cohort in 2012/13.[43] The sustainability of postgraduate provision is threatened by a combination of the knock on effects of the new undergraduate fee regime (the full extent of which is still to be seen), a lack of fee

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[41] University Alliance (2014). *Job Ready: Universities, employers and students creating success*, with further examples at www.unialliance.ac.uk/jobready

[42] Vitae (2013). *What Do Researchers Do? Early Career Progression.*

[43] HESA, HE Students data.

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loan access at PG level, and research funding concentration for postgraduates, particularly through Block Grants and Doctoral Training Centres.

80. Public funding for postgraduate study – both taught and postgraduate is increasingly hard to come by. Alliance universities cross-subsidise in order to invest in the researchers of the future in strategic research areas, but this model is not sustainable or efficient. National funding structures which do not support universities' strategic development of the research base threaten the future strength and depth of the ecosystem. Public funds should support the dynamism of the UK research base by following the principles implicit in the dual funding system: universities must be able to invest strategically in human capital as in other research investment decisions, and funding structures should support them in this.

Taught Postgraduates

81. The future pipeline of research skills is threatened, however, especially for domestic talent supply. Taught postgraduate (PGT) numbers have dropped steadily over the last 4 years, with the numbers enrolling falling by 10% in total. Figure 1 shows how the proportion of home PGT students is also decreasing within this, falling by over 17%, meaning UK students represent only 58% of the first year cohort in 2012/13.[44] These statistics have worrying implications for a 'broken bridge' to postgraduate research from undergraduate, with the majority of PhD candidates now usually required to hold a masters.

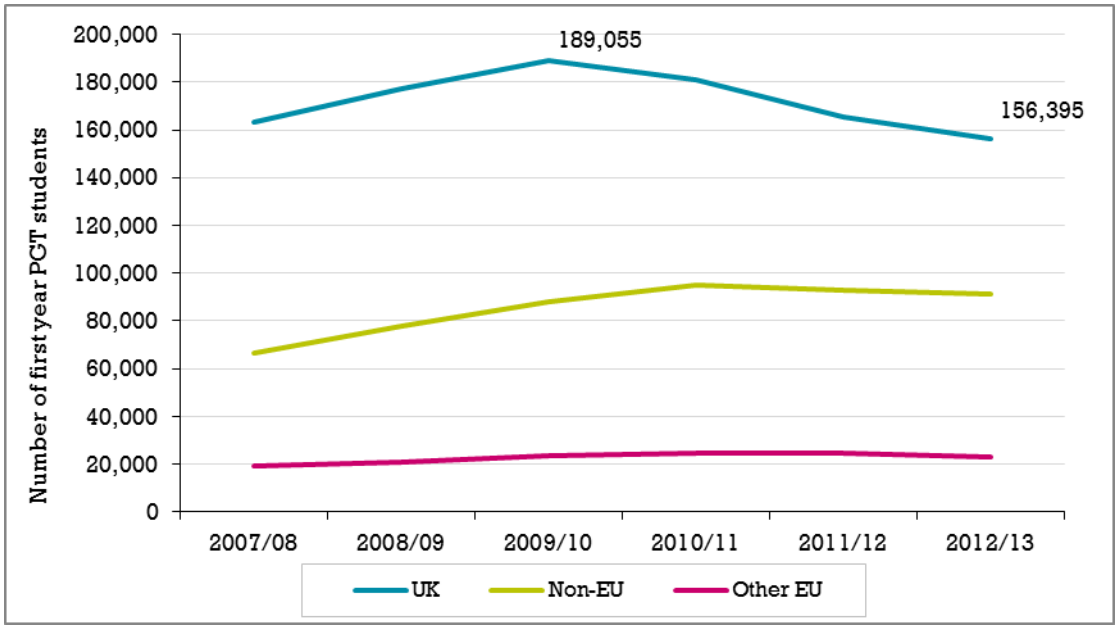

Figure 1. Number of first year PGT students by domicile

[44] HESA, HE Students data – First Year postgraduate students.

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82. Funding systems that include access to loans for taught postgraduate students, such as proposed by University Alliance, would provide a more sustainable postgraduate population.[45] In order to encourage more cross-funding for PGT, the narrative around industry involvement in postgraduate support also needs to be changed. Pilot schemes run by three Alliance universities, the **University of Greenwich**, **Nottingham Trent** and **Kingston** universities are innovating around business/professional access, internship models and skills development, as part of Hefce's £25 million 'lifeboat fund'[46] and are examples of efforts to change the paradigm around business involvement in sustaining the supply of highly skilled workers in the UK and investing in the workforce.

Research Postgraduates

83. The UK also needs to ensure it has a diverse and far-reaching research training system that is flexible and responsive to fast-moving research environments, and world-leading to attract the best talent from across the world. Consideration of how industry-sponsored training programmes might be encouraged should be considered as part of this to ensure that we are supporting a future research base that has the skills to link effectively with business. The House of Lords' Science and Technology Committee 2012 report into higher education in STEM subjects noted the importance of maintaining a diverse complement of training mechanisms, recommending that a variety of PhD delivery models be utilised to ensure that the UK's current breadth of expertise in science and technology is maintained.[47] **Current funding mechanisms which narrow the pool of training centres and supervisors for doctoral students and industrial partners are working against this aim**, however.

84. Research Councils use a variety of different mechanisms and allocation methods to fund postgraduate study. The majority of funding for PhDs is channelled into block grant awards through Doctoral Training Partnerships (DTPs), Centres for Doctoral Training (CDTs – also called Doctoral Training Centres – DTCs) and CASE awards. The introduction of block grants and Doctoral Training Centres, coupled with the removal of PhD researchers as a viable cost in other research grants, has closed off Research Council funding for postgraduate researchers (PGRs) for many university departments and – consequently – for many disciplinary areas where excellent research is undertaken, which threatens the future diversity of the research base. During its last round the EPSRC, the largest funder of DTCs, funded 80 Centres, but these were based at only 28 institutions. Across its three main schemes for postgraduate research, 46 universities are in receipt of postgraduate funding, to the exclusion of excellence in other university departments and disciplinary expertise. Open innovation needs open competition – therefore a commitment to the principle of seeking and funding excellence and developing talent in those same areas must be an essential priority underlying all investments and resulting resources.

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[45] University Alliance (2014). *H.E.L.P. UK: A new Higher Education Loan Programme: adding to the debate on funding*

[46] www.hefce.ac.uk/news/newsarchive/2013/news85254.html#projects

[47] www.publications.parliament.uk/pa/ld201213/ldselect/ldsctech/37/37.pdf

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85. It is also important to consider wider connectivity in the research and innovation ecosystem – operating a revolving door will ensure that strong, sustainable relationships are maintained between the HE research base and innovators in industry. Changes in public funding for Industrial CASE studentships (iCASE) – which co-fund research postgraduates in partnership with innovative companies – has limited iCASE awards from some research councils to those institutions already in receipt of a Doctoral Training Grant (DTG).[48] This restricts eligible academic partners to 44 HE institutions for the largest funder (EPSRC), disbarring institutions with excellent track records in iCASE studentships and business relationships from the system and preventing them from delivering the benefits of their strong industry relationships and collaborative research training offering to students and other business partners.

    a. Funding offered by **EDF Energy** for CASE awards in mechanical engineering to **Oxford Brookes University** could not be leveraged after the changes to EPSRC funding ruled this institution outside of public funding mechanisms for postgraduate training. The same effect was felt by several SMEs engaged with the university via Knowledge Transfer Networks.

    b. **Teesside University** were given 'exceptional' dispensation to run an iCASE award from June 2013 with their partner, **TATA Steel**, only after direct intervention by the company, although the university does not hold a DTG. Eligibility for iCASE awards would allow them to build further on the industry collaboration success that they have achieved in delivering KTP projects (41% of Teesside's KTP projects are graded as 'outstanding', compared with less than 10% nationally).

86. The concentration of funding in these ways limits the diversity of future high level skills. Supporting postgraduates in only a limited number of research institutions narrows the range of the future skills base, excluding many areas of research expertise in institutions outside of these funding mechanisms. It affects the future health of the research ecosystem as universities are being shut out from experiencing, developing and demonstrating capability in these areas. The funnelling effect of both DTGs and iCASE awards also curtails opportunities to involve important strategic business partners in the innovation system – often SMEs – who have strong relationships with those institutions who are currently outside of the DTG system.

87. The concentration of doctoral training, particularly in STEM, into fewer institutions also raises questions about the diversity of PhD supervisors involved in the delivery of training. There are pressures for PhD students to come out fully formed in research and knowledge exchange capabilities, but the existing PhD format – and the restricted number of delivery outlets – may not be optimally designed to help PhD students fulfil their full potential. For example, it is possible that we are not making the most of senior academics – currently outside of the funding system – with relevant expertise and skills, including those from outside of academia, in supervisory roles for PhD students, to act as advocates for the wider skills bases required of doctoral researchers.

[48] www.epsrc.ac.uk/skills/students/coll/icase/Pages/intro.aspx

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How can the UK ensure there are inclusive routes into STEM careers?

STEM diversity

88. There is widespread acceptance of a chronic underrepresentation of diversity within STEM subjects and careers, for which the recent CaSE report on improving diversity in STEM offers constructive and welcome recommendations.[49] University Alliance is one of the 176 signatories of the 'Your Life' campaign to encourage diversity including through inspiring more young people to study maths and physics. We will continue to act as Higher Education advisers as the campaign develops, and have recently signed the Women into Technology and Engineering Compact, which aims to support a step-change in how women and girls are encouraged to consider technology and engineering careers and the subject choices or vocational pathways that lead to them. Furthermore 86% of our members are signed up to the Equality Challenge Unit's Athena Swan Charter.[50]

[49] CaSE (2014). *Improving Diversity in STEM*.
[50] http://www.ecu.ac.uk/our-projects/athena-swan-charter

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